OUTDOORS INDOORS AND UP THE CHIMNEY

CHARLES McILVAINE

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By

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CONTENTS

IF I CAME FROM THE MOON

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Our eyes can see a pin on the floor, and they can see stars millions of miles away so long as their light comes to them. Our eyes are wonderful instruments. They do not have to be pulled out and pushed in, like a pair of opera-glasses, in order that we may make them long or short enough to see things through. There is a little arrangement back of each eye called the retina which fixes itself instantly to see what we want to see, be it near or far.

If we want to see the moon plainly, we use a telescope to help our eyes. It appears to draw the moon closer. If we want to see how the foot of a fly is made, we use a microscope; it seems to make objects larger.

If we look at the moon through a spy-glass or opera-glasses, its surface looks somewhat like a kettle of boiling starch, except that there is

no motion on the moon. It is brighter in some places than others. These bright places are high plains and mountain-tops upon which the sunlight strikes. The darker places are the shadows of the mountains and the bottoms of the deep valleys, where the sun's rays are not falling. If you look down upon a town from the top of a church steeple when the sun is shining, you will notice that the roof-tops, parts of buildings higher than others, are bright, while the lower buildings are darker; and down in the streets and around among the houses it is very much darker because the shadows are there. Here you have at home the same effects that you see upon the surface of the moon. The spots that look like bursting bubbles of starch are the cold openings, or craters, of volcanoes whose fires have gone out.

The persons who make a study of the sun, moon, and stars are called astronomers. They know how to measure the distance these great bodies are from the earth, how large they are, how heavy, and what they are made of. They

have even measured the heights of the mountains in the moon and the depth of the valleys. So, if I read carefully what they say about the moon, I can tell what I should have seen on the moon if I came from there pretty nearly as well as if I had been there. There are very good maps of the face of the moon.

It is right for me to say that I never was on the moon. If I had been, this is what I should have seen and felt:

If I weighed one hundred and eighty pounds at home, I should weigh but thirty pounds on the moon. If I could jump two feet high on earth, I could, with the same force, jump twelve feet high there. The reason for this is that the force which holds us on the earth, called gravitation, is six times less on the moon. What a place for leap-frog! If I were six feet tall here, I should be fully grown at eighteen inches if I had been born on the moon. The man in the moon that the stories tell of would not reach the knee of our men. His dog would not be bigger than a cricket.

I should have with me my air to breathe, and would have to move about in a case so that the air would be inside of it; for there is no air about the moon. I should have to have all the water with me that I required; there is no water, or clouds, or rain there. Everything to eat would be taken along. The moon has nothing living upon it,—at least nothing that breathes air, as all living things on earth do. It is a dead world. Absolute silence reigns there; no ripple of stream, or song of bird, or even the roar of thunder.

It is covered with vast ranges of mountains, somewhat like our Rocky Mountain country. These ranges have been made by the moon's shrinking. If you look at a round squash that has shrunk in drying, you will get a good idea of how these mountains were made.

The surface of the moon is hard, dry, rough, covered for the most part with lava. There is nothing very interesting there.

The moon is 2,162 miles through. It would lie on the earth between New York and Salt

Lake City, and there would be over a hundred miles to spare to walk around it in. The moon is not as solid as the earth. If the moon was squeezed as solid as the earth, it would take eighty moons to make one earth. As it is now, it takes only forty-nine.

We see but one side of the moon, because one side of it is always turned away from us. There is nothing to make us suspect that the side we do not see is different from the one we do see. It is intensely cold there; so cold that the mercury in the thermometer freezes. It freezes at forty-two degrees below zero. The cold on the moon reaches one hundred and forty degrees below zero, nearly four times colder than any place in America! So I will not stay there long. There is nothing to make a fire of. It is the place to get chilblains and frosted noses.

As there is no air, the stars are much brighter than we see them from the earth, and we should see many more of them. As the moon nights are over thirteen days long, there is plenty of time both to sleep and go star-gazing. It takes

the moon twenty-seven days, seven hours, and forty-three minutes to turn around; it takes our big earth but twenty-four hours. The earth is the best spinner.

If I had to walk home from the moon to the earth, and the walking was good enough to make twenty miles a day, I would have to pass thirty birthdays on the road, for the distance is nearly ten times around our earth, or 238,800 miles. I could not have a single birthday party. It would take me sixty years to go and come. I know I should be glad to get home; for, of all the worlds of God's make, this earth is to us the most beautiful.

WHY THE STOVE SMOKES

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If you will take a piece of stove-pipe twelve inches long and six or eight inches thick (eight is better), cut four notches two inches deep in one end, and the same number at the other, then place it upright on the ground, you will have the simplest form of stove that can be made, and the very best for picnics, gunning and fishing parties, and camping out, because, by having several made, so that they will easily slide into one another, several stoves can be carried as one, take up but little room, and are light.

When meal-time comes, make a fire in each stove, place a tin plate on top, put in it whatever you want to cook, cover it with another plate, and soon the meal is ready. By having a section of pipe without notches, and setting it on the heated plate, covering it with another plate

full of sand, you have an oven in which you can roast or bake as well as in a hundred-dollar range.

The air goes into the pipe at the bottom notches, the heat from the lighted wood makes the air above it lighter than the air below the fire; the upper air rises, the lower air rushes through the notches to take its place, and makes what is called a draught. You will quickly notice how the air rises from a fire by putting your hand over it, or a small piece of paper.

Part of the air that goes in at the bottom is used to make the wood burn. (This burning is called combustion.) What is not used passes through the fire, and in doing so mixes with steam from the heated wood, and with the gases and tiny particles of the partly burned wood which are thrown off by the heat; these color the steamed air and the gases, and it goes on upward and off as the smoke we see. If it was not for these particles of unburned wood, we could not see the smoke.

A stove of any make is nothing but a thing to put something in that will burn, and so made

that it will give out all the heat possible from what is burned in a way that is for our comfort or for our use. All stoves have a place for the air to enter, a place for the air to pass through the wood or coal (fuel), and a place for the smoke to pass off to where it will not make the tears come to our eyes or sneezes to our noses.

The stove is simply the biggest part of an air pipe with a fire in it. The straighter and longer the pipe is the stronger the draught will be, because the more heated air there is above the fire, confined to a pipe, the faster it will rise, and the faster the air below will rush in to take its place.

If we shut the draught hole the fire will soon go out. It can get no air. When we start a fire in a stove we usually do it with something that will burn quickly and make a great heat to fire the heavier fuel. This quick fire makes a great heat and a good deal of smoke. The upper part of the stove, the pipe, the chimney, are cold. The first heat with smoke with it has to lift the heavy air above it. Until it does this, and can get away, it has to get out somewhere

else. So the stove smokes. There are two ways of preventing this: The first is to burn a newspaper in the upper part of the stove. This starts the air up the pipe. The next is: Do not have the stove door open or the draught hole open too wide. The smoke will not then be made too fast to get away. Almost always, when stoves smoke during the making of a fire, it is because there is too much draught on. Gas comes from a stove for the same causes.

Stoves often have dampers or valves in them to pull out, push in, or turn. These are usually to turn the heat, and the smoke with it, so that they will not go straight up the stove-pipe, but in a roundabout way through the stove, either to heat the oven or make the stove throw out more heat into the room. The heat from a good fire can be turned in this way, but if the fire is fresh the smoke from it will not go such a crooked road; it goes out into the room,—the stove smokes.

If there is a pipe upon the stove, it, in time, gets full of soot. This soot is made of the par-

ticles that were in the smoke. As the smoke cools while passing through the pipe the steam in it condenses—changes back into water—and carries with it to the inside of the pipe the particles which stick there. These will, if left in long enough, fill up the pipe so much that smoke cannot pass through it. As it must get out somewhere, being pushed by the rush of air behind it and the swelling of the air inside the stove, it slips through the cracks of the stove and often out of the draught hole. This is one reason why the stove smokes. To prevent it you must keep the stove-pipe clear of soot.

If you want to be satisfied that heat swells air, fill a bladder with cold air and hold it over the stove. The bladder will probably burst. If it does not, you can see that the bladder has grown much larger and tighter. While swelling, the air presses alike in all directions. This is the reason smoke is often pressed out of the draught hole. The pressure from within the stove, if the pipe is stopped up, is very nearly the same on the door as it is on the lids.

Sometimes the wind blows down the chimney and pipe, the stove smokes—the draught is upside down.

If the stove-pipe goes into a chimney, which is a tube or pipe made of bricks or stone to make the stove-pipe longer and to carry off the smoke, the chimney may get filled with soot, or dirty. Again the stove will smoke. The chimney must be scraped or a brush run up and down it, or a big fire made at the bottom of it, big enough to set fire to the soot, and the chimney burned out. If the soot was not made from the unburned particles that were in the smoke, it would not burn.

A valve or damper in the stove-pipe, above the stove, is the very best thing from which to learn how to manage a stove. Turning it across makes the stove-pipe smaller. By it the fire can be regulated, the draught can be made full or nearly cut off. It keeps the heat from being wasted by going out the pipe. Before you make a fire in the stove, be sure the damper is turned straight up, or the stove will

smoke when you make the fire. When the fire is started well, turn the damper as much across as the stove will bear without smoking.

Nothing pays better than understanding the way your stove is made, and why it is made the way it is. It saves temper, fuel and comfort. A stove must be kept clean in every part of the inside. All neat persons will take care of the outside.

WHAT DUST DOES FOR US

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Many of the readers of this book will wonder what can be said about dust, except that it is a great bother, which has to be fought off of and out of everything we want to keep clean. If I were to write all that is interesting about dust, and make it as short as possible, half a dozen entire chapters of this book would not hold it.

Stranger yet: while dust contains many of our mortal enemies, it is one of our very best friends, and the finer it is the more we owe to it. If there was no dust, the sky would not be blue, there would be no raindrops, no snowflakes, no hailstones, no clouds, no gorgeous sunsets, no beautiful sunrises. The instant the sun passes out of sight we should be in darkness. The instant it rose it would be a sharp circle of light in a black sky. There would be no evening

glow to chat or think in, no lovely dawn with bird song and cattle low at Nature's wakening. The dome of the sky would be as dark as it is on a bright moonlight night. The moon and stars would shine by day in all their brightness. The whole earth would be in a deep, dark shadow, except where the sun's rays fall directly upon it in one great blinding circle. The moon and stars would make even our shadows.[1]

Rays of sunlight or any other kind of light go straight through all kinds of gases, no matter of what they are made. In passing through them, if they contain no dust, the rays cannot be seen,—they are invisible. You have often seen sunlight enter a darkened room through partly opened shutters, or a crack, or a knot-hole. You have noticed that the rays were full of dust moving about in every direction. The air is made of gases, mixed. You did not see the rays of light; you saw the light in the sun

[1] Most interesting, complete, authoritative, understandable explanations of the effects of dust may be found in The Popular Science Monthly, December, 1891; June, 1893; September, 1894.

reflected by the particles of dust. Millions of these particles were too small for you to see, but not too small for such a searching thing as light to miss.

The light we call daylight is the light of the sun's rays reflected from the particles of dust in the air about our earth. Moonlight is the light of the sun reflected from the moon, which is a great mass of particles compressed into a huge ball. The earth is nothing more. If both of them were ground fine and scattered they would be but dust.

Cut an apple or a potato so as to give you a piece that measures an inch each way,—high, thick, broad. This piece will be exactly the size of a cubic inch of air. Each cubic inch of air contains an enormous number of dust particles. The number is beyond our conception.

Mr. John Aitkin of Falkirk, Scotland, was the first person to count these dust particles. He counted them by a little machine he carried in his pocket, and in a very simple way. He has been able to count seven million and a half dust par-

ticles in a cubic inch of the ordinary air of Glasgow. The air of Pittsburg probably contains ten times as many. After a meeting of members of the Royal Society of Edinburgh in their hall, he counted six million and a half to a cubic inch near the floor, and fifty-seven million and a halt to a cubic inch near the ceiling. The lowest number he ever counted in a cubic inch of air was thirty-four hundred.

The moisture (water) in the air must have something to gather upon (condense) or it will not gather. If dustless air,—air from which all the dust has been sifted (filtered) by passing it through a wad of cotton,—is let into a glass jar from which the dusty air has been pumped, then a jet of steam be let into it, the air will remain clear. The water in the steam will settle (condense) on the sides of the jar and trickle down. But if air which is not filtered be allowed to enter the jar, a cloud will be instantly seen. The steam gathers upon the particles of dust in the air.

So it is that the watery vapor which is con-

stantly rising from the earth gathers on dust particles, forms clouds, fogs. When the air gets loaded with these water-covered particles, they rush together, form drops or snow crystals, and fall to the earth as rain or snowflakes.

The farther up we go in the air, the finer the dust particles are, because the larger ones settle lower.

Several years ago (1883), for many evenings the sky was of a singular, most beautiful color. No one could explain it. It was soon discovered that there had been a great volcanic eruption at Krakatou in the Straits of Sunda, thousands of miles from America. Reflections of the sun's light from the dust thrown up by the volcano, which had loaded the air all around the world, caused the strange sight.

But we are very much interested in dust nearer home. No doubt many of you have wondered how dust gets into your clocks, your watches, your closets, your cameras, and many other places which are closed tightly. Dust is a regular Paul Pry; it gets everywhere. We notice it only where it is not wanted.

This is how it gets there (I did not know until recently, which shows me that I have a great many things to learn yet, and that I learn something new every day. Some of you may be in the same fix. If you are not, it would be well to get there): If you chose to put your watch or clock in a pail of water, no matter how tightly closed you might think it, you would, after a time, find it filled with water. It would get in through the very small openings. Air will go wherever water does. We know that air, when heated, expands, fills a greater space. If you fill a toy balloon as full as you can with cold air, and then bring it into a warm room, it will swell, maybe burst. If (of course before it bursts) you take it out into the cold again, it will get smaller. Air contracts as it gets cold. When the room in which your clock, or camera, or closet stands is warm, the air which is in any one of them is more or less expanded—swollen. When the room gets cold, the air in any one of them contracts, gets smaller. The air from outside rushes in to help

fill up to the same pressure that is outside. It carries its dust particles with it. This change from blowing out air to sucking it in occurs whenever there is any change in the degree of heat. These changes from heat to cold and cold to heat are going on all the while. Dust, when it gets in, usually stays, sticks, until there is enough of it to be scolded at—and cleared out.

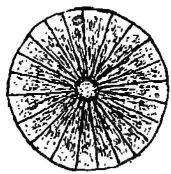
The only way to get rid of dust that settles is to keep busier than the dust.

OUR FRIENDS THE TOADSTOOLS

OUR FRIENDS THE TOADSTOOLS

There are no plants more despised than the toadstools. Nearly everybody is afraid of them, nearly everybody has a kick for them, yet few plants are more beautiful, and but few are more useful. Not a single toadstool is in any way harmful to the touch. Any one can handle them with perfect safety.

When, in the spring, grass has changed from brown sod to a rich green, let the readers look among it. They will find many toadstools growing singly, each very independently, upon a thin stem. Each stem is surrounded by a cap about the size of a good-sized marble, and looking much like a marble cut in half. After dew and rain, the cap is sticky and shiny. Pull one. Turn it upside down. There is no ruffle or plaited collar



Under the cap of a toadstool

laid away for "best" that is half as pretty, regular, and neat, as the plaits or gills that the little plant has modestly hidden under its brown cap. These gills, running from the stem to the rim of the cap, may be brown, or they may be black. If they are black, they probably have so many minute white specks upon them as to give them a mottled appearance. All kinds of toadstools having gills under the caps are called agarics. By far the greater number of toadstools you will find belong to this family.

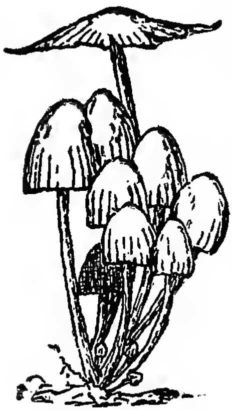
These gills are wonderfully made. They are composed of two thin plates made up of cells. They are very much like a fan when nearly closed. If these gills could be opened,—spread out flat,—they would show, like an opened fan, considerable surface. Strawberries bear their seeds upon the outside, agarics bear their seeds upon the outside of their gills. These seeds—or spores, as they are called—are so small that it takes over two thousand of them, placed end to end, to make one inch. Each one of these seeds, small as it is, contains a germ that will

produce a toadstool. No matter how great or how small, the work of the Creator is perfect. The color of the gills is usually due to the color of the seed. If the seeds are brown, the gills are brown; if black, the seeds are black when they are ripe and ready to fall. And they fall in such great numbers that if you will place the cap of a gilled toadstool, gills down, on a piece of white paper, and place a tumbler over it, in a few hours the fallen seeds will make an exact print of the gills. These seeds are eaten by insects which devour the substance of toadstools, and are carried off to their holes, or they are wafted away by the winds and scattered far and wide. When they reach a spot that suits them, they grow.

Strawberry plants blossom before they fruit as most other plants do. Toadstools do not. They are flowerless plants, like the ferns, and hence are called cryptogamic, from two Greek words, meaning "hidden marriage."

Notwithstanding toadstools have so many seeds, they have another way of growing.

Grapevines, for instance, year after year, grow from roots in the ground; they also grow from grape seeds. When the seed of a toadstool grows, it does not throw one shoot upward to make a toadstool and another down to make a root. It throws out countless thread-like fibers, often as fine as cobwebs, which run through the earth or leaves in every direction. You have often seen these among layers of rotting leaves or stable manure, and perhaps wrongly called them mold. This thread-like, matted, cobwebby substance, usually white, is the vine from which toadstools grow. Toadstools are, therefore, a fruit growing directly from a vine, but without a preceding blossom, such as the grape has. This vine lives year after year in its proper home, and each year produces its crop.


A group of brownies

When the common mushroom is grown in cellars and houses built for the purpose, the beds are made of manure. The dried vine is bought in brick-shaped masses, and is called "spawn." Pieces of this are buried in the bed, where the heat and moisture revive the vine, start it to growing again, and in time it bears fruit. An old writer wrote, "Doubtless God could have made a better fruit than the strawberry, but doubtless God never did." The same can be said of mushrooms. A mushroom is a toadstool.

Not only among the grass, peeping at one another, and playing hide-and-seek like brownies, are the early spring toadstools found, but at the base of trees, along pavements, and in solid clusters, with egg-shaped brown caps, delicate and brittle, they often grow in great quantity. These caps frequently sparkle as if finely powdered mica had been sifted upon them. These, as well as the little fellows found in the grass, are beautiful when dissected, and they excel all flowers by being most luscious eating when

stewed for a few minutes, and seasoned with butter, pepper, and salt.

The puff-balls, so well known by the fine powder (spores) which puffs from them when squeezed, are handsome when they are quite young. If you examine the quite small white kinds found in pastures and along roadways, you will be surprised to see how exquisitely their surface is covered with pyramidal groupings. All puff-balls are fine eating (fried like egg-plant, or stewed in milk) when they are pure white inside. When they have the slightest tinge of yellow they are bitter, but not poisonous.

Many of the wood-growing toadstools are brightly colored. Arranged on plates of moss, they make bouquets which every one will admire.

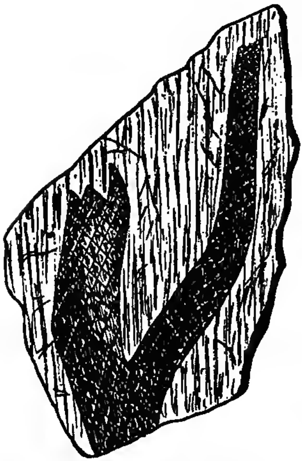
Do not despise the toadstools, a study of them is delightful. To know them assures one of good company when walking through woods and fields.

ONLY A LUMP OF COAL

ONLY A LUMP OF COAL

Before cold weather comes, the wise housekeeper sees to it that there is either a pile of wood or a heap of coal ready to do the house-warming for the winter. She buys enough coal or wood to make a comfortable temperature in the house. In coal we have a portable climate,— one that is brought from mines in the earth, carried in cars to the coal-yards, and carted to our cellar windows. We can carry our climate with us wherever we go. Our stoves are our domesticated suns, giving us warmth within the shadows of our home walls and upon the darkest night. Excepting when the coal rattles from the cart to the cellar, or the fire gets low in the stove, or we do not feel much like leaving a comfortable chair to fill the coal-scuttle, or the coal bill has to be paid, we do not think much about coal; we are so used to it. If a piece of either hard

or soft coal could tell its story we could spend many an evening very pleasantly listening to it. But as the coal cannot talk, persons, called geologists, who have examined the countries and layers of rock from between which coal is mined, and who have carefully studied how these rocks were formed, tell us that coal was made many thousands of years ago. They tell us, too, how coal was made, having collected from the coal-mines hundreds of proofs that their story is true.



Lepidodendron elegans.
Impression of coal-making fern; much reduced.

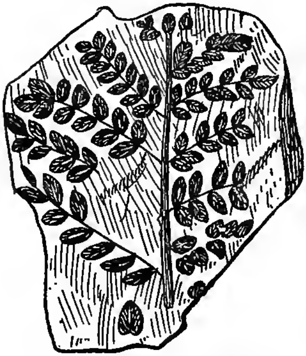
There are many kinds of coal, but the two principal kinds are hard and soft coal,—anthracite (meaning a kind of precious stone) and bituminous, which means containing bitumen. In the United States hard coal is found east of the Alle-

gheny Mountains only, excepting small deposits in Colorado. Soft coal is found west of them. The coal we burn in our stoves is hard coal; that which is used in blacksmiths' fires and largely under locomotive and other boilers is soft coal. Hard coal makes very little smoke; soft coal makes a great deal. In hard coal, between ninety and ninety-five parts in one hundred are carbon, —the same substance which makes up the diamond and the lead in our lead-pencils; the same substance which largely makes up charcoal.

Away back, long before man or any living animal came upon the face of the earth, the air about it was warm and full of moisture. Immense sharks, lizards, and fishes lived in the waters. If a boy could have hooked one of them, the boy would have gone home with the fish instead of the fish with the boy. Very much like the old colored man who was pulled into the water by a big catfish. He said:

> " I couldn't help a-figgerin'
> Whether dis niggah went catfishin' or de catfish went a-niggerin'."

The plants which grew then were enormous. Many of the ferns were as tall and thick as our largest trees. The plants were principally of the fern kind. They grew over broad sections of our country (now called our coal fields), and in great quantities. There were extensive forests of them. In many places the club mosses,—very like those now growing,—grew plentifully, only much larger, even to fifty feet high. We know this, because where these ferns and mosses fell upon the soft soil of the mud and sand they made the impressions of their trunks and branches. Many became hardened, many in time became coal, and are found as they stood or fell. A favorite fishing seat of mine in the West Virginia mountains was upon the trunk of one of these great ferns. It was

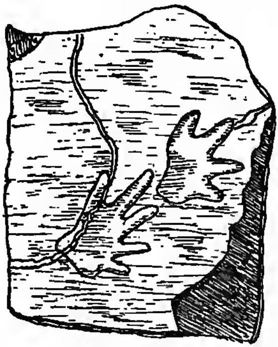


Impression from coal; much reduced.

two feet thick, and stuck out of the vein of coal to which it belonged (it was beautiful coal itself) for several feet. A thick shelf of sandstone was above it; a slate floor was under it; a lovely pool was in front of it. From this I hooked many a fine black bass. I could see the prints of the leaf sockets and the grain of the wood. And I used to try to picture how the giant fern looked when it was alive and higher than any of the oaks and sycamores about me! That is, when the fish did not bite well.

For thousands of years these ferns and mosses grew, fell, and made beds where they fell. These in time were covered with mud and sand carried over them by slow flowing water. Later these layers were hardened by heat into slates, shales, sandstones, making thick layers of rock above and below the beds of vegetable matter. And there they are to this day. The vegetable matter, because of being pressed under such enormous weight and heated to a high degree, had the gases driven from it. By these and such chemical changes as we often see in piles

of hay and straw, or weeds from the garden, it was changed into coal. I owned a slab a foot square which was taken from a coal-mine. It had on one side a perfect impression of a fern-leaf which had been changed into soft coal, and on the other side a layer of charcoal half an inch thick. Any one who will look over heaps of soft coal in the lump will find plenty of fine impressions and changed plants. These are not so often found in hard coal.



Footprints of reptile on sandstone,—coal-fields of Pennsylvania.

Coal is then of vegetable origin. Our coal-oil — petroleum —is from the same source. Coal is still being formed in the great peat-beds of Ireland. What is called Irish bog-oak, from which knife-handles, brooches, bracelets, and other ornaments are made, is wood partially changed to coal.

Coal is always found in beds or veins. Some-

times they show on the mountainsides, far up toward their tops. Streams of water have, in long periods of time, washed courses among the mountains, and left what were once hollows far aloft. Coal-beds are frequently piled one upon another. Often they are far down in the earth, and are so broad and long that the places from which the coal has been taken seem like countries under ground. Large shafts—like wells—go down to them; huge platforms, moved by steam, go up and down, carrying the miners to their work, powder for blasting, feed for the hundreds of mules which live their whole lives in underground stables. They bring up coal, which is hauled to the hoist by mules attached to cars through miles of narrow tunnels.

Fresh air for the miners to breathe is drawn through the tunnels by fans, or by building great fires in an upgoing shaft which makes a chimney of it. The fire draws air down other shafts and through the mines. Powerful engines pump up the water that would flood the miners out if left in the mines for a single day.

When the coal-laden cars reach the surface they are pulled by steam cables up an incline track to the top of a high building called a breaker. Here the cars are unloaded into strong crushers, which mash the lumps. The crushed coal falls upon slanting sieves with different sized holes in them. The fine coal goes through first. The sieve sorts the coal. Each size falls upon a slanting chute, on which it slides down to large bins, from which it is drawn into cars standing on railroad tracks ready to be loaded. When they are loaded, they are weighed and started off for different parts of the country, to whoever has ordered them.

There are many other things to tell about the coal-mines and the handling of coal. Pieces of slate which stick to the coal when mined are knocked off with a hammer and thrown away. Slate that is mixed with the fine coal is sorted from it in a peculiar way. The fine coal runs down a trough filled with water. On each side of this trough are many wooden boxes, in each one of which a boy sits. The coal and water

run into this box. Here it is thrown up by a movable board and passes over another board on which the water is shallow. Coal is lighter than slate. The current of water carries the coal on. The boys catch the slate and send it off another way.

A great many boys are employed in coal-mines as mule drivers and to open and close the iron doors at every crossing or branching tunnel when any one passes through. These doors turn the air which is drawn through the mines in the right direction, so that all the miners and mules can have their share. If it were not for these doors the fresh air would take the shortest cut from where it gets in to where it is drawn out, and miners in the tunnels not on this short cut would not be able to work in air that had been breathed over and over again.

Those who wish to know all about a lump of coal should get a little book, A Story of a Piece of Coal, by Edward A. Martin, in the "Library of Useful Stories," thirty-five cents, D. Appleton & Co., New York.

OUR INDOOR NEIGHBORS, MICE

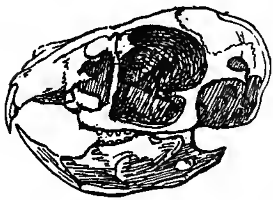
OUR INDOOR NEIGHBORS, MICE

The smallest, neatest of animals is the mouse. It is peaceable and quiet except when romping with its playfellows. Mice never bite persons or other animals unless they are caught and try to defend themselves. An ordinary mouse weighs about one ounce. A medium-sized woman weighs 1,760 times as much. You can easily see why (and should remember it) a woman has never been eaten by a mouse, and that even a baby is several times too big for a mouse with the biggest sort of appetite to eat within a year or so. It has not yet been discovered why most women are afraid of mice, though it is well known why mice are afraid of women.

Mice belong to the order Rodentia or Rodents, meaning gnawers. To this order the gopher, beaver, squirrel, porcupine, guinea-pig, prairie-dog, hare, rabbit, and rat belong.

One third of all the mammalia or milk-giving animals belong to the Rodentia.

Their two lower and two upper front teeth are unlike those of any other animals; they are hard and sharp as chisels on the front edges and very much softer back. As they grow the soft backs wear down, and the chisel edges are kept sharp for gnawing hard nuts and other things by whetting against each other. The front teeth grow. If a front tooth is pulled out, the one opposite, not having anything to grind it off, will keep on growing until the animal cannot shut its mouth or eat. The teeth of all other animals, our own great selves included, do not grow one particle after they are first fully formed. This is the reason our teeth gradually wear away. The jaws of mice and other rodents move back and forth to grind their food. Ours move from side to side; so do those of cows and horses.



Skull of a rodent

If any reader of this volume thinks it easy to gnaw a hole in the floor or a board, try it. A mouse has no trouble, because its teeth project, are made for cutting, and its nose is not in the way. When a mouse wants to go from one room to another, or wants to get into a box after good things, it gnaws a door for itself, and never has the politeness to shut it. A very good thing for nearly everybody to do is:

> " Please keep this legend on your door,
> As you are going through it:
> To pull the door to after you
> As far as you can do it."

The common house-mouse and brown rat, which is nothing more than a big mouse, were originally brought from Asia to America. The house-mouse is a beautiful animal, sleek and cleanly. It spends quite as much time over its toilet as young ladies do. If mice had looking-glasses, they would undoubtedly keep them out of a great deal of mischief.

When my office was in Philadelphia, I fell in love with a pretty lady-mouse that used to visit

me often. By kind treatment I made her gentle and loving. I called her Mary. Each day I gave her choice bits saved from my luncheon, or carried to her from my home. She came to my desk to eat them. If I did not feed her, she searched my pockets. One day she brought with her into the room eleven of her children. I was in a fix. I did not care to run a mouse boarding-house, or even a school for mice. Yet they were Mary's children. Soon I had them very tame. Then I made a calculation. Mice have their first families when about four months old, and have three and four families a year. In a year Mary would probably expect me to educate and board forty-four of her children, and if half of her children were daughters, about 1,500 grand- and great-grandchildren, provided they all lived. I was scared at the prospect. I put Mary in a comfortable cage, and supported her until she died. Her children—but my cat never told me what became of the children.

Mice eat large quantities of insects which are house pests. In doing this, and in cleaning up

things which would decay and be unhealthy, they are useful; but Mary convinced me that it is better for us that mice should have as short lives as possible.

There are many kinds of mice. All of the kinds are interesting. The long-tailed mouse, which lives in old trees and such retired places, is the brightest, most fascinating animal I have had to do with. I fed a family of them one whole winter where they nested in the top of a wooden gate-post. I would not have missed their daily, bright-eyed welcome on any account. In the spring they disappeared. Following a long tunnel running from the bottom of the post, I found a great store of what I had given them, together with an ample supply of food they had laid up in the autumn for themselves. The little rascals had completely deceived me, and no doubt laughed at my charity. But I had my pleasure out of it.

Ground- or field-mice are exceedingly destructive to grass and grain crops. Their runways cover the ground in most fields. They

are dumpy, and have short tails. They too eat insects, grubs, and worms. They have many enemies, or they would get more of the crops than the farmers do. In France, as many as thirty thousand of them have been killed upon one acre of ground. A new means has just been discovered for destroying them.

We are apt to think that the little house-mouse does the most damage, because it gets the first bites of so many things we like, and often spoils whole pans of milk by drowning in them.

There is a good story told of two mice that fell into a pot of new milk. One gave up swimming in despair, sank, and drowned. The other, with more pluck, kept on swimming round and round until it churned a lump of butter. On this it crawled out and saved its life. "Never despair" is a good motto.

ONLY AN EGG

ONLY AN EGG

If a hen's fresh egg is put into water heated to the boiling point, which is 212 degrees of heat by the thermometer, and allowed to remain there for from three to five minutes, then taken out and broken open, the contents of the shell will be partially hardened (coagulated). Everybody knows what a good breakfast is therein. If this same egg had been placed in the same boiler, without water, but with fresh air, and the heat kept at 103 degrees all the time for twenty-one days, a live chicken would have broken the shell by its own force, and would very soon have asked for a breakfast for itself. Or, if the egg had remained under the hen that laid it for twenty-one days, the heat of her body (she would have been feverish while sitting on it) would have changed the clear, stringy fluid and the yellow yolk into a chicken. The hen that

lays the egg is the mother of the chicken; the hen that hatches it is the nurse.

This wonderful change from the "white" and "yolk" of an egg into a live chicken with blood, bones, flesh, feathers, sight, hearing, and a voice piping loudly for something to eat, is brought about by a regular heat lasting through a certain number of days. If the egg gets too hot or too cold, or does not get moisture enough from the air, the making of the chicken inside of the egg will be stopped. The egg will be spoiled. A spoiled egg is unfriendly.

An egg is very much like a seed, only that it is made of animal matter instead of vegetable matter, because it is intended to produce, or grow into, an animal. Every plant begins from a seed; every animal, from the elephant to the mouse, from the whale to the minnow, from the ostrich to the gnat, begins with an egg.

A hen's egg is made up of several parts. The shell is composed of lime. Through this, air and water, in the shape of moisture, can pass in slowly. Directly inside of the shell is a thin,

tough skin (membrane). This prevents the moisture in the egg from getting out through the lime shell. If there was nothing but the shell, the egg would dry up.

The white of an egg, as it is called, is a substance called albumen (al-bu′men). It surrounds the yellow yolk, which is also largely albumen. On the outside of the yolk, fastened to it, you will often notice a white jelly-like speck. This contains the germ. The germ is so small that it cannot be seen without the aid of a powerful microscope. Until the hen sits upon the egg, or it is placed in an incubator to hatch, the white and yolk protect the germ—keep it floating so that it will not be jarred or fastened to the shell, or be injured in any way. The air space at the large end of the egg acts as an air cushion. An egg without a live germ in it will not hatch. There would be nothing from which the chicken could grow. Neither will a seed grow if the germ is destroyed.

Albumen forms part of all blood, the juices of flesh, the clear part of eyes. It also forms part

of all seeds and plants. There is very little difference between animal and vegetable albumen.

The albumen from eggs is used to give the gloss to photographs, and largely in the printing of the colors and figures on calicoes. It clears coffee by getting thick (coagulating) in the hot water, sinking, and carrying down the fine particles of coffee (grounds) with it. In cakes—you know how it is used in cakes.

A sitting hen seems to us to be a disagreeable old crosspatch. However much she snarls and pecks, she is but doing her whole duty. She is protecting her nest and the, to her, precious eggs in it. She has her rights and sticks up for them. After a hen has been sitting on a nest of good eggs for five days, if you hold one of the eggs up to a bright light (keeping light from shining around it), by looking through it, you will see a tiny speck with a hammer-shaped head and a short, thin tail. If you had a proper arrangement for magnifying it, you would see that there was life in it.

By the tenth day veins full of blood can be seen running and branching through the white of the egg. In darker places the head and parts of the body will be taking shape. Each day will show a change. The air space at the large end of the egg grows larger. By the eighteenth day the chick is nearly finished. Between the twenty-first and twenty-third day the chick breaks a small hole in the shell. This is called "pipping." The egg is said to be "pipped." Through this hole, which is at the chick's beak, it breathes. After practising for a while, it kicks and struggles until it breaks the shell into two halves, around its middle. Then it rolls out —a weak, jerky, wet chick. Very soon it dries, pokes its head out from under the hen's feathers, and takes its first look at the world. The old hen talks to it,—hen talk,—and no doubt tells it about breakfast to be had—after a while, and a much larger world, with worms, for it to look at when she takes it off the nest.

Think of it! In twenty-one days what would have made good cake, or pudding, or omelette,

turns into a pretty, active, live chicken, with ideas of its own; and heat brings about this wonderful change.

Nowadays, hatching eggs under hens is too slow work to satisfy many persons who raise chickens. They buy incubators, which are large, wooden boxes heated to a regular heat by lamps. Inside this box from fifty to two hundred and fifty eggs are placed at one time. They hatch as well as if an old hen sat on them, and in the same time. A hen cannot cover more than fifteen eggs. The incubator forces her out of the sitting business. All she has to do now is to lay eggs.

The egg which hatches never makes a mistake. If it is a hen's egg, a chicken comes forth; if a humming bird's, a humming bird is hatched from it; if an ostrich's, an eagle's, a duck's, it produces young after its kind. Even the shape and color of the feathers are imitated.

A humming bird's egg is not much larger than a filbert. An ostrich egg holds three pints. The eggs of a shad are the size of a pin head.

The eggs of turtles and snakes are covered with a tough skin. They do not have a hard shell. The sun's heat hatches them. I often find turtle and snake eggs in my potato patch, when the ground is soft, and the rows stand where the sun has a good chance at them. When the young are hatched, they hide under stones and roots until they get used to things.

Collections of birds' eggs for study are pleasant and instructive. Taking birds' eggs for fun is not funny at all when we come to think about it. Every egg taken kills a bird. Is killing fun?

ON THE SEASHORE

ON THE SEASHORE

When one stands on the shore at Atlantic City or anywhere on the eastern shore of the United States and looks east, toward where the sun rises, no land is in sight; nothing can be seen but water and waves, sea-birds and sailing or steam driven vessels. From this grand body of water things are constantly being thrown upon the shore by the waves, and there are a great many most interesting animals which live in the sands of the beach and nowhere else.

The pebbles of all colors are pieces from rocks under the sea or from those which have fallen into it from the shore. These pieces have been rolled about on the sea bottom, have been dashed against each other and against the shore, until their corners are ground off and they are round and smooth. Many of the pieces are ground into sand. The ocean's mill is a big one.

The shell-fish and sea snails live in the ocean in countless numbers. Sometimes they are thrown on the beach alive; oftener the shells of those which have died are carried ashore by the waves. Frequently these are broken and the pieces are ground smooth. That part of them which looks like pearl, and is pearl, being hardest, is the last to be ground. This is why nearly all beach shells have the pearl luster. Many of them are bored full of little holes. These are made, largely, by a snail which has a long tongue, like a ribbon, set with fine teeth, sometimes as many as 600 of them. This toothed tongue cuts the shell, and the animal that lives inside of it is eaten.

The sea has its own vegetable growths as well as the land. They are often called seaweeds. Most of them are mosses. One of the most beautiful collections I have ever seen was of the pressed and dried sea mosses found on the sea-coast of California. No feathers or lace could be more delicate. These growths are the Algae (meaning seaweeds). They are found in both

salt and fresh water. They live by taking (absorbing) their food through their surfaces. Irish moss is a sea delicacy which is made into candy. Fine glue is made from the gelatine found in several of the seaweeds. Iodine is made from others.

The animal life of the seashore is the most interesting to a great number. Quite a common shell is the Pear conch. It is a snail. All

Pear conch

Conch eggs

the conchs are snails. When alive they burrow in the sand. Most of the conch shells found are six or seven inches long. I have one nearly two feet in length. The egg cases of the Pear conch are plentiful. They are the queer looking strings of odd-shaped parchment like plates found lying on the sand. If one is carefully sliced open, the very small young conchs may be found inside. At the small end of the string a pebble or piece

of shell is usually fixed. This is the anchor the snail used to fasten its eggs to the sea bottom or some other firm place.

The whelk belongs north of Boston, yet its shells are frequently found farther down the coast, but worn by being washed so far from home. It, too, is a snail. Codfish are fond of it. So are the people of England. They eat about one hundred thousand dollars worth of whelks each year.

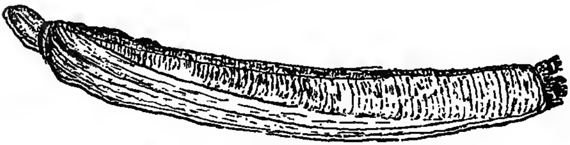

The whelk

Off from the seashore where the tide pools lay, several shells less than an inch long are found. Some of these are related to the true whelk and are called dog-whelks. They live on living and dead animal matter, boring the shells of other animals to get their food. Nearly every castaway shell of the dog-whelk has a tenant. The hermit crab keeps house in it and pays no rent.

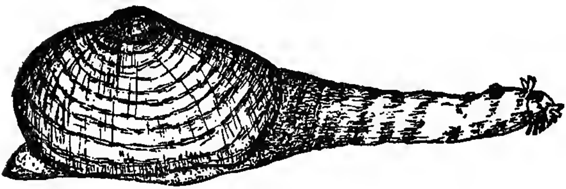
The little round-mouthed snail—the periwinkle—clings to the posts, seaweeds, marsh grasses, just where salt water will wash and give it drink, without taking away its breath by too long a ducking. Periwinkles are good to eat when picked out. When I was an army officer, during the great Civil War, and was stationed on our coast, I had many a good meal of them. Most of the soldiers turned up their noses at the idea of eating "snails," as they called them, which was all the better for me. Over two thousand bushels a week are sold in the English markets during the height of the periwinkle season, from March to August. The periwinkle is a vegetable eater.

I skip the common clam and oyster, though they are interesting to know about. The soft-shelled sand clam—the maninose—has a shell so thin that it breaks unless handled very carefully. It looks a good deal like the common fresh water mussel. Low down on the sand-bars at the mouth of creeks and inlets, where the water seldom leaves the sand long enough

for it to dry, lives the maninose—a foot under ground. It has a long extension from the back part of its body which it raises up to the surface through a tube in the sand. This tube is made by the slime off the clam's extension sticking the grains of sand together. In this long exten-



Razor-fish



Soft-shelled clam

sion are two tubes—siphons they are called. The clam runs up its extension, draws the water, which contains all the food it gets, down one tube and forces it out the other. It has a perpetual restaurant passing through its stomach all the time. As you get near it, or when you

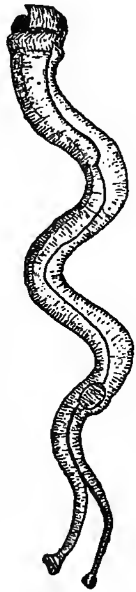
strike on the sand, it draws in its tube quickly. This forces the water out of it, which makes the squirt into the air, often seen. I often shoulder a spade and go down on the fine beach in front of where I live, and dig for maninose, when I see that the tide is low enough. The maninose is delicious. If you get a maninose, without breaking its shell, place it in a pan of salt water and you will see it run out its long extension.

The oyster, clam, mussel, and maninose are called bivalves—*bi* meaning two, because they have a shell on each side, opening on a hinge. The shells are called valves; hence the name—two valve.

Some of the shell animals are powerful borers. They bore holes in the hardest rocks.

Pieces of wood, bored so as to leave the wood looking like a sponge, are common on the beach. This boring is done by the Toredo or ship-worm. It is not a worm but a shell-fish. It destroys timber, which it can get at, in a very short time. It has been known to bore through thick wharf supports in less than eight weeks.

The scallop shell is very common. It looks like a little spread fan, without a handle, excepting that it is scooped, and is scalloped on the outside. When there are small comb-like teeth on the hinges, which lock the two shells when closed, they belong to the Arks. The long, narrow shell, looking a little like a razor-blade, belongs to the razor-fish. It lives from two to three feet under the sand. Like the maninose, it has a long siphon to get its food by. Strange to say, it can see with this siphon, which is in the place for a tail.



The Toredo
or
ship-worm

The lumps of clear jelly—the jelly-fish—which look as if they ought to be eaten with a spoon, are beautiful when floating about in the water. The jelly-fish is a very singular animal. It grows by budding. When in bathing, if one is struck upon the body by the

jelly-fish, sharp stings are felt, which burn for a long time. In August, when I look down from my high bank into the clear Choptank waters, and see hundreds of jelly-fish swinging their long tassels beneath the waves, I do not go in bathing. The little jelly-fish is my master.

UNDER CREEK WATERS

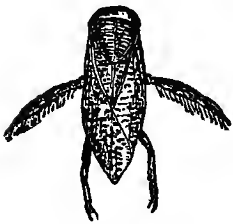
UNDER CREEK WATERS

The swirls, ripples, furrowed currents of the tumbling creek water, make a curtain over the pebbles, stones, gravel, and sands of creek beds, through which we cannot well see the living things which make their homes among them and the curious life work which goes on there. In the still pools, quietly moving eddies, and shallow water along the banks, are the places to make our calls and find the curious animals at home.

Around the edges of stones small piles of sand, gravel, pebbles, tell that the crawfish has dug them out from underneath and left an always open doorway for itself, and that it rests under the solid roof ready to dart on any prey venturing within reach. The crawfish is a water highwayman. A scavenger, too; it eats dead fish and other dead things which, if left to decay,

would make creek water unpleasant and unhealthy.

By the way, you will hear a great many persons say "crick" instead of "creek." But you will remember that creek should no more be called crick than Greek should be called Grick or cheek be called chick.



Water-Boatman.

Crawfish can be caught with a small dip net or with the fingers. When catching them with the fingers it is best to get the first hold. They have ten legs, four small ones on each side, for walking, and two large ones forward, having immense powerful claws for holding their prey. When a crawfish catches a finger it does not let go when asked.

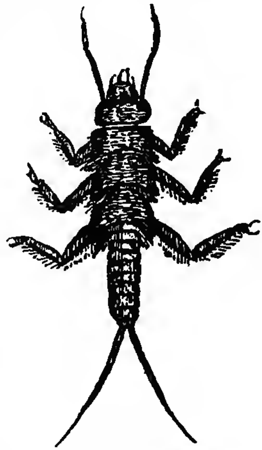
Each crawfish is born from an egg. As it grows it changes its hard outer covering. One cannot help wondering how it pulls its big claws through a very narrow, hard-jointed wrist covering each time it changes its coat. It is very

like pulling a hand out of a tightly buttoned glove. The difference is this: the flesh of the claw has no bones in it, and the new covering is softer than kid. The flesh and cover stretch. The crawfish pulls. The claw comes through the wrist like a string, then pulls itself into shape. I have watched crabs pull themselves out of their shells. Their claws are nearly the same.

The crawfish darts through the water by using quick strokes of its powerful tail. The flesh of its claws and tail are much more tender eating than that of a lobster. When they fight, which they often do, they chase each other. The one that succeeds in clipping off, with its claws, the other's tail, wins the battle. When they lose claws, legs, even eyes, others grow in their place. Crutches or spectacles are of no use to crawfish. They are closely related to insects. Though they have true gills with which they breathe, they have jointed bodies.

Where the water runs swiftly, the nymph of the stone-fly, in great numbers, has its early home

under stones. It sticks so flat, and looks so much like a part of the stone, that if it were not for its six legs and bristle tail, few, excepting the small boy after fish-bait, would notice it. Fish are fond of it.

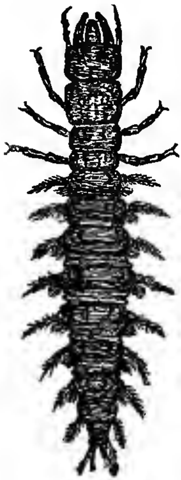


Nymph of Stone-fly.

Nymph is the name given the young of insects which do not live for a while in the pupa state as do moths, butterflies, and many others. They do not pass through all of the strange changes from the egg to the full-grown insect. When the nymph of the stone-fly sheds its skin for the last time, it leaves its water home and becomes a greenish or gray fly with slender fore-wings and with hind-wings of beautiful delicacy. Sometimes you will find the flies upon the snow in springtime.

Gray and black mottled bugs, called water-

boatmen, never over half an inch long, swim through the water, glistening like silver spangles, or cling to the bottom like sunken coins. They carry their own air with them. They live inside a bubble, breathing the air over and over again. The moving water cleanses the air and supplies them with fresh particles as they swim through it or move it about them by paddling with their side legs.



The Dobson.

Very much shaped like the water-boatman is another bug called the backswimmer. It always swims on its boat-shaped back, with a bubble of air between its wings. When scared, it turns over and flies away. How jolly!

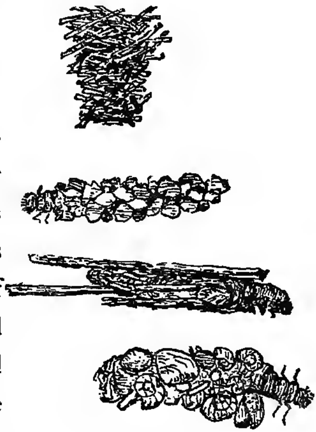
Every fisher-boy and fisherman knows the worth of the Dobson—crawler or hellgrammite—as a bait for fish, especially the black bass. The young or larvæ live under stones where

the water runs fast. They feed on the stone-fly and whatever other live things they can catch. Their skin is so tough that fish do not easily get it from the fisherman's hook. He can often trade one Dobson for several fish, which is a pretty good trade. The Dobson lives as a Dobson nearly three years. It then crawls to some shelter out of the water, but near to it, builds a cell, stays in it a month, then comes out as a savage-looking insect with exquisitely veined wings. It lays from two to three thousand eggs where the young, when hatched, can easily get into the creek and grow to be Dobsons. It then dies.

In pools of the lively little streams coming from springs, and in the quiet places in creeks, live the caddice-worms or sand-toters, as I was taught to know them. Lie down along the edge of one of these pools and watch the bottom. What seem to be fixed cribs of grass, or bundles of sticks, or rollers of sand, or tubes of silk, will come to life and move about in the everlasting search for something to eat. A

closer look will tell that a larva (worm) has put out the forepart of its body from within a silken tube it has spun from its mouth, and is using its legs as if used to it. To protect itself, it has gathered bits of leaves or grass, built them log-cabin wise around its tube, and fastened them together with silk; or it has built up grains of sand around its tube like the stones of a well-wall, cemented them with silk, and lives comfortably safe within. One species covers its case with snail shells. When the snails are alive they haul the caddice-worm about. There is style for you,—a worm with its carriage and snails!

Caddice-fly.



Caddice-worms.

Another species fastens pebbles to the under

side of stones with silken threads. Between them it has its silken home. Near-by, between two stones, often on the surface of rocks, it weaves a funnel-shaped net with its open mouth to the running water. Across it are meshes regular as those of a spider's web. In these set-nets the fisher-worm catches small fish and other swimmers of the creek, and lives off of them in grand caddice-worm style.

Many kinds of leeches move slowly over the stones and plants. They have suckers at both ends of their bodies, but only one end bites. Before I knew better, I once put several creek leeches into one of my aquariums with beautiful fish, which were favorites of mine. The next morning all the fish were dead. The leeches had fastened on to their gills and bled them to death.

Newts, often miscalled lizards, are plentiful under stones at the water's edge. They are hatched from eggs. When hatched they are like tadpoles. In growing they keep their tails. Newts have stubby, cushion-like toes without nails. Lizards have claws.

There are hundreds of other curious things under creek waters. The water world is a big one. If we make acquaintances of the creek people, we will find them pleasant companions all our lives, and when we grow old, can lovingly call them playmates.

SCARES THAT ARE USELESS

SCARES THAT ARE USELESS

I think it was King James II who said to one of his soldiers when he was boasting that he did not know what fear was, "Hech, mon! then you never snuffed a candle with your fingers." We jerk our fingers away from anything hot because we know they will get burned. This is a proper scare. We are saving our personal property; our fingers belong to us. It is always right, and never cowardly, to keep ourselves and others from being hurt.

It is a good thing to think about what we would do in different kinds of danger; because if we should ever be in the kinds of danger we have studied, we would know what to do, having already made up our minds.

If we know what to do or say instantly, it is called presence of mind. The English comic paper, Punch, once said: "There is but one thing

better than presence of mind, in danger; that is, absence of body." This is true, but we do not always know when to be absent.

A great many persons, young and old, think they are in danger when they are not. They get scared. These scares are useless. As they are very uncomfortable to the persons getting scared, and often frighten other persons, it is well to know how to avoid them.

Mice come first as the makers of scares. They are the smallest and prettiest animals we have. They are shy, easily frightened, and scamper to their holes on hearing the least noise or seeing the least motion. A mouse never hurt any one. If mice happen to be white and have pink eyes, we make pets of them. If their fur is brown, we prance about, get on the piano, and scream. There is a consolation in all this,—the mouse is scared as badly as we are. The best plan is to sit still, make a little noise if the presence of the mouse is unpleasant, and it will quickly disappear. Exactly the same thing can be said of rats,

excepting that as they are a few times larger than mice, the scare is bigger. Another very good plan to avoid these scares is to think for five minutes how very uncomfortable it must make the little animals to frighten them badly.

Next, spiders. How exquisite their webs are when strung with dew beads, or when sparkling with raindrops, or stretched as perfectly made nets to catch their maker's food. Then, too, how exquisitely decorated spiders are when examined under a magnifying glass! How neatly joined are their legs! How delicate their spinners! How wonderful their eyes! How industriously they attend to their own business! How many flies, mosquitoes, gnats, bugs, they capture, and take from bothering us!

Yet, oh horrors! Let one—even a timid daddy-long-legs—come anywhere near, and great big human bodies will jump, strike, shoo, screech, grab the broom, and be in mortal terror. A useless scare. Few spiders will bite any one unless coaxed to do it. If, then, they do bite, their bite is no more than that of a mos-

quito or flea. There are but two spiders whose bite is severely poisonous: that of the tarantula, a native of hot countries; and the female of a pretty black, polished, red-spotted spider which belongs to a family noted for staying at home. There is no use in being frightened by spiders.

There is nothing that will stir up more racket and make the girls—young girls, old girls, and grandmother girls—get their heads covered quicker with newspapers, sewing aprons, even coal-scuttles and dustpans, than a bat in a room.

The bat is not a bird; it rears its little ones as the cow does her calf. There is a well-known cow that is said to have jumped over the moon, but she did not fly. The bat is the only four-footed animal that flies. The flying-squirrel does not fly; it floats or sails from one tree to another. It always lights lower down than the place it starts from. The bat flies to catch insects. Attracted by a light, it comes into a room. Then it flies about wildly, trying to get out. The way to get it out of a room is to take the light out; the bat

will follow the light. Really, now, who ever knew of a bat getting in any one's hair? And if one did, did it carry the hair off? Bats do not bite unless they are taken hold of. Their ugly wrinkled faces are very much like those of pug dogs. Yet who is afraid of pugs? Brace up, and keep braced up when a bat is about. The bat should be honored; its squeak is the highest sound we can hear.

The most of us do not like snakes. The reason is that a snake which we have all read about often and often, and which people have heard about for several thousands of years, behaved very badly in the Garden of Eden. So we have been taught to dislike snakes. The dislike is bred in us. We do not try to stop it. We either scamper as fast as we can from a snake, or kill the poor creature, and are frightened all the time we are doing it. Stand still when you see a snake; it will slowly, bashfully, steal away. It will live to do more good for the farmers than any other wild creature. It eats mice and insects that injure their crops, and it kills the insects in

cellars, gardens, and about the milk-houses. Very few snakes bite. Our common snakes never do. Their tongues are soft, and can hurt no one. The rattlesnake lives in wild places, and it is polite enough to tell you to stand a little farther off. No snake in America will chase you. The copperhead, viper, puff-adder, are all cowards.

Not one of the beetles that comes buzzing into the light at nights, and drops on the floor with a bang and straddle, will bite. Pick it up fearlessly. When bees, wasps, hornets, come about, keep perfectly still and they will not sting. Make a quick motion, strike at them, and they probably will. Almost every year I have two or three pet hornets. I stroke them, and they like it. They are very interesting. I would as soon think of stepping on my watch as I would of stepping on an insect; it is so perfectly made, such a fine piece of machinery.

Before you get scared by anything, always think how much scared the other thing is.

THE BEGINNING OF PLANTS

THE BEGINNING OF PLANTS

There are many seeds so small that we cannot see them with the naked eye. The seeds of all toadstools can only be seen by the help of a powerful microscope. It takes from two to four thousand toadstool seeds laid end to end to reach one inch. The size of a seed does not appear to make any difference in its life. It contains the germ that, properly planted and cared for, will swell, sprout, grow into the same kind and sized plant that bore it. The seed of the giant Sequoia of California, through the largest of which a street-car can run or a load of hay be drawn, is not as large as the seed of the little parsley. The poet has written, "Mighty oaks from little acorns grow."

Every plant grows from a seed. There are many plants which grow from roots and cuttings, but the plants these roots and cuttings

are taken from began in seeds. Let us see how:

When seeds are ripe, perfected, they usually fall to the ground. They may be blown to a distance by the wind, carried off by birds, or scattered by their explosive seed pods. Some, like the burdock and Spanish needle, have hooks, which catch on one's clothes, the wool of sheep, or hair of animals, and are carried away from home to start new patches for themselves. Perfect seeds are alive. Many kinds sprout (germinate) as soon as they strike the ground. Others do not germinate until the next spring. Some seeds, if not planted, die in a year or two. Some—the seeds of the sensitive plant—keep alive for as many as sixty years. The way to tell whether or not seeds are alive is to place them on wet cotton, in a warm place, under a tumbler. If alive, they will sprout.

A seed contains the germ of a new plant. This germ is surrounded by more or less food for the young plant. Over the whole is a skin or hull. Soak a grain of corn or a chestnut or a

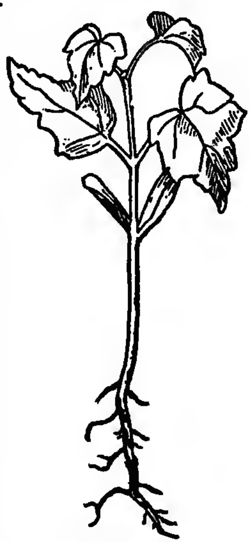
bean until it is soft; then carefully split it across its width. At the point you will find the germ nicely folded up. All of the matter about it is food stored for it to consume when it is ready for it.

When a seed strikes the ground, and is on a spot which suits it (it may be in a crack of the soil, or rain may splash dirt over it, or a bird may scratch earth to it), dampness, moisture, warmth, passing in through the hull, swell it, the hull bursts, the germ unfolds. The part of the germ stem which first comes from the hull turns downward, and strikes for the ground beneath it. This is the root. It then branches, grows in size and length, branching all the while as it has more work to do in passing up to the branches and leaves above the food it collects. The roots are not dumb-waiters, as we shall see.

a. Germ in a grain of corn.
b. Grain sprouting.

The other end of the germ stem always turns

upward. The seed leaves (those which were along with it in the seed), seek the light, air, and sun warmth. The stem grows longer, the leaves get above the ground, spread themselves out, and begin their work of changing, with the help of the light and air, the food passed up by the roots into new wood, new leaves, and all that goes to make a little plant or a giant tree. Between the two seed leaves a tiny bud shows itself. It swells and opens into two leaves. The stem under these grows and hoists them higher. This budding, stem growing, branching, goes on until the plant, or whatever it is, is finished far enough to bear blossoms and ripen its seeds.



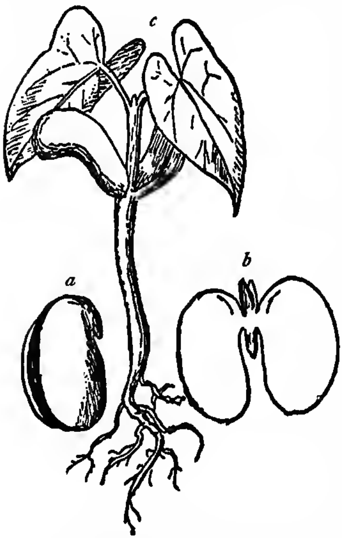
This growing, branching, goes on.

The best way to learn and remember how a

plant begins is to lightly plant a lot of seeds—clover, corn, wheat, or morning glory—in a flower pot. After the seeds swell, each day take one up and examine it closely. By doing this you will make Nature tell you very pleasant stories and show you a great deal that you ought to know.

The food that is collected by the rootlets in the ground, and is passed up by them, is not ready for the use of the branches and leaves. It all has to go to the leaves to be cooked, as it were, by the light and air. It then returns through the cells of the plant to make wood, roots, even leaves. The extra matter which surrounded the germ in the seed fed the very young plant until it spread its seed-leaves, and could begin business for itself. If you cover a thrifty plant with anything that will keep out all the light and air, the leaves will whiten, the plant will die. The roots are busy all the time, but the food they pass up does not get properly changed. It is not digestible by the plant. The plant dies of starvation.

In the bean, which is a very interesting seed to study while germinating (sprouting), the food for the young plants is stored in the two thick seed-leaves, which are the two halves of the bean. It is these seed-leaves which we eat, and which are so luscious in the lima bean. Another bean has drawn the attention of the world to Boston. Large beans should always be planted with the stem side down. The great seed-leaves (halves of each bean) will be set right to push up through the earth. I know a gentleman who left the city to try farming (of course, he believed he knew all about it), who, when his lima



a. Bean splitting. *b*. Open, showing sprout. *c*. Seed-leaves and second leaves.

beans came up, thought they were wrong-side up. So he turned them all!

The acorn swells, bursts the hull, and divides like the bean. So does the chestnut. But the two halves remain in the hull, and are not made use of as first leaves. They furnish food for the young plants. Acorns grow prettily when set in a hole in a card over a glass of water. The lower part of the acorn should always touch the water. The growth of peas can be watched by the same plan. Many of the plans of plant-growth, with good plain descriptions and illustrations, can be found in "How Plants Grow: A Botany for Young People," by Professor Asa Gray.

A great number of plants and trees have the power of starting new growths from their roots, or cuttings of their branches. The locust and ailanthus trees are well-known tree producers from their roots. Yet they both grow plenty of seeds. Potatoes are not the seed of the potato plant. The seed grows on the top of the potato vines. Yet pieces of potato, each having

one or two "eyes" (which are sprouts) upon it, are always planted to grow the new crop from.

Strawberry plants, dewberry vines, wild raspberries, run out arms or shoots along the ground. At a joint, roots are thrown out, which grow into new plants. Grape vines can be increased in this way.

A common plan for getting the kind of fruit wanted is to take a cutting from, say an apple-tree, cut the lower end wedge shape, and insert it in a split made in the stump, or in a branch of another apple-tree. As many kinds of apples can be grown on one tree as there are branches to place cuttings in. This is called grafting. The begonias, cacti, and several other plants can be grown by planting in the earth the edges of pieces of their leaves.

The grand purpose and work of every living thing is to produce after its kind. The effort of plants to do this in several ways is truly wonderful.

But, after all, the little seed is the true beginning. A good many habits, besides those of

plants, grow from very small beginnings. In starting a crop of habits, choose them as carefully as you do seeds,—plant the best only, cultivate well, keep clean of weeds.

PLANTS THAT POISON

PLANTS THAT POISON

No one will care to know whether the old Mother Goose story is true or not,—

> " There was a man in our town,
>   And he was wondrous wise;
> He jumped into a bramble bush
>   And scratched out both his eyes;
>
> "And when he saw his eyes were out,
>   With all his might and main
> He jumped into another bush,
>   And scratched them in again."

That the man saw his eyes were out, is, odd to say, the least of it. Nevertheless, there is an example in the story. Several common plants cause a good deal of scratching to be done by those who get too near them; another kind of plants immediately stop the need for scratching. The man who jumped out of one bush to be cured in another was not such a ninny after all.

It is well to know the poisonous plants when we see them, and quite as well to know what will surely destroy their poison if we are unfortunate enough to get it upon us.

One of these poisonous plants is known as poison ivy, poison vine, poison creeper, poison oak. Its proper name is *Rhus radicans,* which means rooting sumac. The roots meant are those issuing from the under side of the vine, which enable it to cling to whatever it runs upon. This poison vine grows where it pleases and is wide spread. If it does not find anything to run upon, it is satisfied to remain a low bush or shrub. In this shape it often forms large patches. The peach tree and apricot will run like a vine if supported. In England they are usually grown on trellises or supported by a wall facing the south.

Poison ivy.

The poison vine has but three leaves at the

end of each leaf stem. The American ivy, or Virginia creeper, a very common plant often grown for ornament, has five leaves on each leaf stem. When a three-leaved plant looking very much like the American ivy is found, it is best to keep away from it. The flowers are greenish. The fruit of the poison vine stays upon it long after the leaves have fallen. It grows in clusters and is a white, smooth, waxy berry.

The poison is contained in all parts of the plant. It is not volatile—which means that it does not spread through the air. Until within a few years it was firmly believed that the air about the plant would poison. This is a mistake,—it will not. The poison must be touched. A very small particle of it will cause intense itching, then inflammation, then blisters. The inflammation spreads rapidly, and causes great suffering. Many a summer's holiday has been spoiled by it. If one's clothes touch the vine, the sticky poison is carried home. Handling the clothes afterward will have the same effect as touching the vine.

Being an oil it will not wash off with water alone. Weak alcohol will remove it, and if sugar of lead, which is very poisonous if swallowed (it should be carefully labeled and kept in a safe place), is dissolved in the alcohol and rubbed upon the affected part, it will destroy the poison.

By far the best, quickest, and surest way to ease the pain, prevent the spread, and cure from the effects of the poison, is to rub the skin with oil of goldenrod. Every family, every camper-out, every one who wanders in parks or woods or along country roads, should have a small vial of it, and should rub it on the skin the moment the itching begins, or the inflammation shows. A very small quantity is enough. The whole inflamed surface should be covered with the oil, and whenever a new spot appears it should be touched with it.

When the skin is broken by scratching, the oil of goldenrod smarts a little. When the whole body, or large patches of it, are poisoned, one-third of sweet oil may be mixed with the

other. One application to one place is enough. It cures instantly.

The oil of goldenrod can be bought at druggists'.[1] Many do not keep it but have to order it. This takes precious time. It is best to have it at hand.

This perfect cure was given to me many years ago by the men who make charcoal in the New Jersey woods. They are constantly exposed to the poisonous vine. To them, poisoning by it means loss of their labor and the money they get for it.

Goldenrod grows in great quantities almost everywhere. The charcoal burners gather it and make their own oil. Sometimes they simply rub themselves with a bruised handful of the stems and leaves.

For several years a lady in my family was made seriously ill by *Rhus* poisoning. As she was usually my companion on tramps after

[1] The oil is imported from Germany. I know of but one drug firm importing it—George D. Feidt & Co., 528 Arch Street, Philadelphia. The oil costs 40 cents an ounce.

specimens, she dreaded the poison vine. It seemed impossible for her to escape it. Seven years ago, after serious poisoning, she used oil of goldenrod. It cured at once. She has not been subject to the poison since. She even glories in defying it. I do know that this oil is a perfect safeguard. I do know that it is a certain, quick cure, and in many cases the persons have not been poisoned since.

Poison sumac.

Some persons, among them myself, can handle the poison vines and not be affected by them. When I was a boy I was badly poisoned. Once was enough.

Poison sumac (*Rhus vernix*), poison dogwood, poison elder, poison ash, poison wood, poison swamp sumac, thunder wood, are other names given to it. It grows up to thirty feet in height. It has leaves somewhat like the common sumac,

but more slender and delicate. The leaflets number from seven to thirteen. Its poison has the same effect as that of the poison ivy. It is cured in the same way. Several of our plants are said to be poisonous to the skin of some persons. Among them are the leaves of celery and parsnip, if wet. I cannot vouch for this. The nettle irritates by pricking; several of our grasses by cutting. The irritation which follows is not due to poison.

Any gardener, farmer, park laborer, will show you the poison ivy, if you do not already know it. If you do not know, and want to know, never be ashamed to ask. Many persons remain ignorant all their lives, because they pretend to know and are too foolish to ask for information.

A STUDY OF FLIES

A STUDY OF FLIES

The very next time you have nothing to do, it will very much interest you to watch both the capers and the earnestness of the common house-fly.

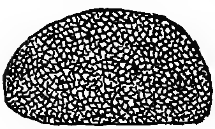
It is a wise rule to make use of loafing minutes. Many years ago I taught myself that it was a good thing, whenever nothing-else-to-do times came along, to look about me and see what was going on. I always found something busy at its life work,—a bug or a bird, some many-legged or some few-legged animal, even plants. Thus idle moments are made interesting and instructive, and the world holds more for us. We become more interested in it; our horizon widens. All information is of use some time or other.

The house-fly is usually at hand, or at nose,—as you please. It has six legs and two wings.

It requires much care on our part to move two legs with ease, grace, and safety. But the fly is never bothered with his six (unless it be on sticky paper). It is far ahead of us in motive-power. It could even lose a pair of legs without needing crutches. It moves them with the greatest ease, and at high speed. It uses them for many purposes. It sleeps on them. How springy they must be! It is not particular whether it goes to sleep hanging by them on the wall, or swinging by them from the ceiling, or resting on them standing up. With its pair of hind legs it scratches its back, dusts the upper and lower sides of its wings, and combs out the hairs upon its body with their stiff bristles. And this done, it sticks its legs out behind while rubbing them together to clean out the combs. Resting on its hind pair, you will often see it using two or four front legs to wipe off its thousands of eyes, clean the fore section of its trunk, rub down its long, limber sucker which we call proboscis, then shake hands with itself in a comical way as if to thank itself for the cleaning.

The sucker, which you see run in and out of its head and poked upon all sorts of eatables, as if it was a little stamper, is the fly's mouth. Instead of taking the food to its mouth, it sends its mouth for the food. It is spread out at the end to make a sucker. If the food is liquid, it sucks it up; if it is hard, it secretes a fluid, wets it, dissolves it, then takes it in. We partially moisten our food in our mouths; the fly does it outside. In this way it eats granulated sugar.

What appear to be two great eyes and nearly all of the fly's head, are really thousands of eyes set side by side. There are no lids to them; they never wink at you. When a fly wants to move its eyes it has to turn its head, just as the owl does. Neither can move its eyes. The fly's eyesight is sharp. Pretend to strike one with your hand. It will fly away, and probably come back at once. If you again raise your hand, even at some distance from the fly, it will leave. If you want to hit a fly, wait



Eye of common house-fly, from inside, greatly magnified

until it is busy eating, or combing itself; then open your fingers and strike. If you strike with closed fingers, the rush of air from under your hand will carry the fly out of danger. This is the reason why a whisk-broom or a wisp of wire now sold for the purpose of whacking flies, seldom misses them,—the air passes upward through them. A newspaper roughly folded is good as a fly-killer. The air is driven in different ways by the folds, and the edges of the folds strike the fly before the currents of air do.

House-flies proper, those in the far greater number in the house, do not bite; they have nothing to bite with. There is one, called the stable-fly, which bites sharply. It visits the house and looks so much like the house-fly that, unless you know a great deal about flies, you will mistake it. You will surely know it if it bites. It really does not bite, neither does a mosquito; it pierces the skin with its proboscis.

No fly grows after it leaves the grub state and becomes a fly. There are big and little flies, but not in the same family of flies. There are no

baby flies. A fly is as big when it is first born as it ever is,—unless it gets at the molasses or preserves. You see large and small flies in the house, and, naturally, think they are all house-flies. They are not.

Flies do not lay their eggs in the house. The mother-fly goes to the stables, and lays about a hundred and twenty eggs. Then she goes visiting. She cares nothing more for them. In twenty-four hours they hatch into little grub-like affairs,—larvæ. In this state they eat ravenously for from five to seven days, and change their skins, which get too small for them, three times. Then they go into another state,—the pupal. In this they change into flies. This takes from five to seven days more. Their funny-looking cover bursts, out they come, and very soon they become sociable.

Flies are cunning, sly, persevering, and full of fun. You will often see them teasing and playing with one another. That they tease us, no one will deny.

FIREFLIES

FIREFLIES

You have read so many pretty ideas about glow-worms and fireflies and have so many pretty ideas of your own that you have almost ceased to think of them as things: very much as you do of the rose, the violet, the lily of the valley. It is real hard to think of the rose as having stickers. It puts the rose on the level with a brier. It is not easy to believe that the glow-worm is not a worm; that the firefly is not a fly; they are not often thought of as anything but beautiful lights; yet the truth must be told; they are both beetles. The glow-worm is the female of one species; the firefly the female of another. The females show their lamps; their male admirers go to them.

The glow-worm is a wingless female, which looks very much like a stupid grub of some sort. The pale-green light it shows is steady.

It glows. The lightning bug (firefly, fire-beetle), has wings—two true wings, two wing covers. Its light is flashed where it pleases Mistress Beetle to flash it. These flashes come so suddenly out of the dark that they are not unlike spots of lightning. That is the reason the fire-beetle is often wrongly called lightning bug.

We naturally wonder how it is that an insect carrying enough light to make several hundred bright flashes, neither burns up nor sets anything on fire. This is one of the greatest of puzzles. It beats any of the puzzles in the papers or magazines. The glow-worm and the fire-beetle have the secret of making a light without perceptible heat. A spark of anything burning, many times less than the size of a fire-beetle's light, would burn your fingers if you touched it. The fire-beetle is always cold.

One summer night I stood listening to the roar of an approaching storm among the roofs and steeples of Cambridge, close by. I noticed a few fireflies flashing their lanterns among and high above the treetops of a near-by grove. In

a moment the wind struck the trees with violence. Instantly the air was full of fire streaks. Thousands of fire-beetles were driven from their perches, and in their flight the flashes of their lanterns were carried like a rain of sparks upon the blast. The unusual sight was so real that for an instant I was startled. I did not at once think of the cause. I feared some of the outbuildings would catch fire.

Swarms of the fire-beetles are sometimes immense. A marvelous story is told in one of the Government Reports upon "Insect Life," which tells of a swarm in New Jersey that made night as light as day, frightening the people and waking the chickens.

Along the banks and over the lake-like eddies of Elk River, in West Virginia, I have seen the fire-beetles so plentiful and brilliant that their flashes in the air and reflections in the water gave me the thought that the Milky Way of the heavens had come down to bathe in the cool waters of the river.

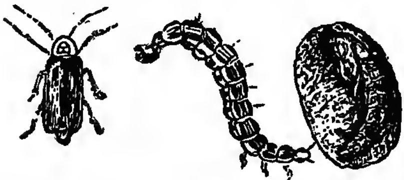
There are several kinds (species) of fire-

beetles. The largest live in South and Central America, the West Indies and Cuba. Fine print can be read by the light of one of them. A few of them confined together give enough light to write by. Some of the people of these countries use them for lighting their houses. Ladies fasten them on their hair and in their dresses to flash as living jewels. One of the early historians of Central America gives an interesting and curious account of these fireflies. He says: "They have two stars close by their eyes, and two more under their wings, which give so great a light that by it you can spin, weave, write, and paint; and the Spaniards go by night to hunt the utios, or little rabbits of that country, and a-fishing, carrying these animals tied to their great toes or thumbs, and they call them locuyos, being also of use to save them from the gnats, which are there very troublesome. They take them in the night with fire-brands, because they make to the light, and they are so unwieldy that when they fall they cannot rise again, and the men stroaking their faces and hands with a sort

of moisture which is in those stars, seem to be afire as long as it lasts." In China the poorer students use a species of fire-beetle to light them while they read. The Chinese boys, no matter who or what they are, have a great prize ahead of them. If they study hard, and are bright enough to pass the early examinations, they may in time become rulers of districts, governors, and be ennobled. A good thing about the Chinese law is that, if a Chinaman by his energy and brains becomes a noble, his parents are made nobles for bringing up such a child. His children have to rise by their own worth. There is always a far greater prize than simply nobility ahead of an American boy or girl who studies. This is a knowledge which, if properly used, will bring every other good.

The name by which the fire-beetle, firefly, lightning bug, passes in insect society is *Photinus pyralis*. *Photinus* in Greek means light, shining. *Pyralis* comes from a Greek word meaning a winged insect supposed to live on fire. It is about half an inch long, slender, and

has a soft body. Even the wing covers are rather soft. All the fire-beetles have eleven joints in each of their feelers,—antennæ. The best way to know one when you see it in the daytime is to catch one when it tells on itself at night. The true fire-beetles fly only at night. Their eggs hatch grubs or larvæ. These feed on earthworms and insects with soft bodies. When the grubs are ready to change into another shape, they cover themselves with an earthen cell. In this they pass, without eating, from larvæ (grubs) to pupæ. This is usually in June. In ten days after they shut themselves up in earthen cells they come forth full-grown fire-beetles, with their lanterns inside of them. If you will place one on the face of your watch you can see the time by its light.



Common firefly. *Photinus pyralis.* **Larva.** **Pupa in its cell.**

Very small things, which persons have not

seen before, will often get up very big scares. It is told that away back in years a number of persons landed on one of the islands of the West Indies at night. They saw distant woods lighted up by great numbers of fire-beetles. These they supposed to be Spaniards coming by torchlight to destroy them. They scurried off to their ships and left.

Decaying vegetable matter sometimes gives forth light. I have read a newspaper by the light of a certain kind of decaying toadstool. It is probable that the light of a fire-beetle is made by the vegetable matter which it eats. This decays inside the beetle. I hope you will take my word for it, and not mash fire-beetles,—the light is steady within the beetle. When the beetle wishes to show it, it moves certain parts of its body,—opens its lanterns. If a beetle is mashed between your fingers in the dark, the light will show for a short time on your fingers.

We all admire the stars,—we have them all the year round; but we feel more at home with the fire-beetles,—they are more sociable.

THE BUSIEST OF INSECTS

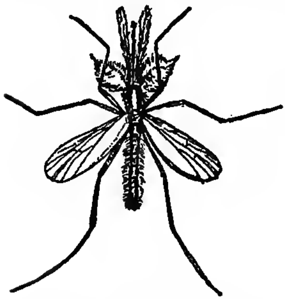
THE BUSIEST OF INSECTS

The mosquito is wonderfully interesting, yet the person who has never seen or heard one is fortunate. Usually we have to hunt for the natural history specimens we want to study; the mosquito hunts us. We are specimens for the mosquito. They enjoy us, too. It would be interesting to know what they say about us. They no doubt have opinions of their own about thick-skinned and thin-skinned people, and know the daintiest delicacies in ears and ankles. They must have thrilling stories to tell of their narrow escapes from whacks, wet towels, pillows, and the dreadful scoldings that follow them.

Adult female

Just what use the mosquito is has not yet

been discovered; but that it is of some great use, and that it takes its place in the perfect plan of Nature, there can be no doubt.

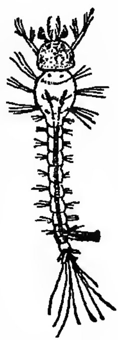


Adult male.

Everything under the sun has its use. Because a thing does not seem to be of any use to us is no reason at all that it is good for nothing. It is well to learn early in life that while we make use of everything we can, there are a great many minute forms of animal life which make use of us, and are our masters.

The life history of the mosquito is quite a story. Early in the spring, depending upon how warm it is, the female mosquito flies from the sheltered place in which she has slept all through the winter, to some fresh water pool or marsh, or barrel of rain water, and lays from two hundred to four hundred eggs. These are set on end and stuck together in a saucer-shaped

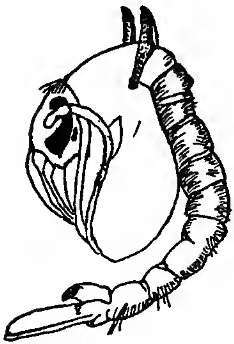
mass which floats on the water's surface. In about sixteen days the eggs hatch. The little wrigglers (larvæ) have jointed bodies, big heads, and many bristles about their mouths which move quickly and catch the tiny microbes which live in still water that is not very fresh. These they feed to the mouths of the larvæ. Though the larvæ live in water, they have to come to the top to breathe. They are heavier than water; they have to wriggle hard to rise for breath. The weak and sickly drown because they cannot rise to air. After growing for seven or eight days, and changing three times, they become pupæ, odd looking wrigglers with big bodies and jerky, jointed tails. They are now lighter than water. They have to swim hard to get to the bottom. When they stop swimming, they slowly rise to the top. If oil is poured on the water, it spreads over the entire surface in a thin layer or film. As neither the larvæ nor pupæ can get air through the oil, they drown under it. A little



Larva, greatly magnified

coal oil poured into all pools, rain-water barrels, puddles, every week, will kill nearly all the young mosquitoes.

In two days the fully grown mosquito bursts from its pupa covering and comes out with six legs, one pair of wings, and a long beak or proboscis, through which it feeds. The female mosquito does all the biting. The male is easily told from the female by the feathery antennæ or feelers alongside of its shorter beak. The female has short hairs upon her antennæ. If one does not care to examine carefully those mosquitoes which light, to find out which is Mr., and which is Mrs., the Mrs. will soon tell on herself by planting her legs firmly by her hook-toothed feet, driving her beak through the skin, and setting one frantic by the thrust.



Pupa, greatly magnified

As each female lays from two to four hundred

eggs, and there are from ten to twelve generations a year, the millions upon millions of mosquitoes are easily accounted for.

I have seen vast armies of them, so thick that I could not open my mouth without their entering. The bite of a mosquito is poisonous.

During the Civil War I was in command of the picket line on John's Island, South Carolina. At night the mosquitoes swarmed about the men on guard in such hordes that their bites drove some of the men crazy. I had to take their guns from them. Several men were in the hospital for days, swollen, ill, from their bites. Several battery horses were killed by the mosquitoes. I was dangerously bitten.

These hordes of mosquitoes are found in the far North as well as in warm regions. In Alaska, in extreme Arctic regions, mosquitoes are at times more numerous than in New Jersey. The United States Government Report upon the insect says that in 1866, when the snow was several feet deep and the ice on Lake Superior five feet thick, the mosquitoes literally blackened the

snow in sheltered places. Farmers living in Vermont and New Hampshire have told me that calves were often killed by them there.

Not more than one mosquito in a million gets a chance to feed upon the blood of an animal. Mosquitoes are vegetarians. Why they ever drink blood is not known. They are fond of bananas and other fruits. I have seen them in great numbers, feeding on the stalks of the red clover.

It takes a very small pool to give birth to a large number of mosquitoes. One rain-water barrel will yield more than enough to satisfy a village. The water in one barrel was filtered and found to contain 17,259 eggs, larvæ, and pupæ. A month later the same barrel yielded another crop of 19,110. This number multiplied by ten furnishes quite enough mosquitoes to go around.

Because hedges, trees, bushes, shelter many mosquitoes, persons think they breed in them. This is not the case. So far as is known, they breed only in water.

About two hundred and fifty species of mosquitoes are known. Of these, thirty have been found in the United States.

While mosquitoes are known to carry disease germs from one person to another, and from unhealthy places to persons, it is possible that they may, too, carry preventives of disease. They do destroy countless microbes in stagnant water and may thus prevent disease. We can rest assured that (sneaking mean as they are) they are for some good.

JACK FROST

JACK FROST

If there were such creatures as Fairies and Brownies, Jack Frost and his family—White Frost, Black Frost, Hoar Frost, Rime, Ice, Snow—would certainly be among the busiest and best of the lot.

When you and I and our grandmothers were little, we as firmly believed that Jack Frost was a jolly, roguish, invisible imp who nipped our ears and noses and made our cheeks rosy (when we poked our heads out of doors on a cold morning) as we did that Kris Kringle came down the chimney on Christmas Eve and filled our stockings with good things. The time comes for all of us to learn what Jack Frost really is. It seems to be a pity that we have to say "Good-by" to him, for we knew him, and liked him right well if he did not nip too hard, but we grow wiser as we do it.

Here is what Jack Frost, in his many forms, really is: The air which surrounds the earth, and which we breathe, contains water in such small particles that we do not always see them. If you will take a glass quart preserving jar, screw on the top, set it in ice-water for half an hour, drops of water will collect on the inside of the jar. Of course they could come from no other place than from the inside air. If you warm the jar again, the drops will go back into the air.

When air contains as many particles of water as it will hold, it is said to be saturated. How much water it will hold depends upon how warm or how cold it is. If warm air is cooled, it will let go its hold on a part of its water particles. You see these dropped particles on the outside of a pitcher of ice-water or a glass of cold water taken from the well. These collections of water particles are called condensation.

If you will turn a tin dishpan or tin plate open side down upon the sod of your lawn and leave it there all night, in the morning early you will

find the inside quite wet. The reason is this: The earth under the pan contains water. The earth is constantly giving up its water to the air by evaporation, which is what happens when you hang wet clothes out to dry. Now, then, the earth gives its water to the air; the tin pan, at night, gets colder than the air under it; the air gives up its water to the tin pan. On the grass alongside of the tin pan you will find dew-drops. At night the grass is colder than the air, so the particles of water coming out of the earth and the particles of water in the air about the grass, gather upon the grass. This gathering is called dew. When particles of water come together they have an attraction for one another. They huddle together in ball shape. These tiny balls are our glistening dewdrops.

Suppose the heat leaves the air and earth until the mercury in the thermometer stands at the 32 mark. (There is no such thing as cold. There is such a thing as heat. Cold is the absence of heat.) The 32 mark is called the freezing point. Water freezes at the 32 mark. As

the air cools it lets go a part of its water. The water, collecting as dew, freezes. Freezing is a wonderful change in water. You may be surprised to learn that water is a mineral. The stones, rocks in the fields, the pebbles on the sea-beach, are made up of several kinds of minerals. Minerals of all kinds crystallize,—that is, under the right conditions they form into crystals. Each mineral has its own shaped crystal. Water, at 32 degrees of heat, crystallizes, takes the exquisite shapes we find in frost, snow, the ice on our window panes. Just before water freezes, and at any time when it is not frozen, the particles of which water is made glide, fall, tumble, revolve about each other, and are in what we call a fluid condition.

The particles of which mercury is made do the same thing. When the freezing point 32 is reached, the particles of water rush to fixed lines, pile one upon another, and so close together that they make hard masses. To the different forms of these masses we give different names. White frost is not quite as hard as

black frost; the crystals of snow are not as hard as those of ice.

Some morning when the mercury in your thermometer is below 32, take a shallow pan or dish of water out into the open air. Rest it where it will be perfectly still. Watch it. You will see the lines forming. These lines will cover the whole surface of the water. When they are well formed, gently slip a piece of stiff black paper under them. Lift the paper out. On it you will have the framework of ice. Or, of a right cold morning, dash water against the outside of your window and from the inside watch it freeze—crystallize. Watching Nature do her work is not lost time.

Science comes from the Latin word *scientia*, which means "knowledge." Scientists are those persons who work systematically to gain knowledge. They study the laws of Nature, which govern everything about us. To them we owe our microscopes, telescopes, spectacles; our stoves, furnaces, telegraph, telephones, and almost everything man makes for his use and comfort.

To them we owe our artificial ice, which largely takes the place of the ice which used to be gathered from our ponds and rivers. Strange to say, the first ice scientists made was made inside a platinum crucible heated to a white heat. Throw water on a hot stove griddle, it will take ball shapes and dance about. The steam between the water and the griddle prevents the balls from touching the griddle, and bounces them about. The water in the balls is cold. Wet your finger in your mouth, and hold it up in the outside air. The side next to the wind will feel much colder than the side away from it. The wind evaporates the water quicker on the wind side. It is this plan which is used in making ice. The hot crucible evaporated the water so rapidly that a part of it froze. The stove griddle works in the same way. In making ice in large quantities, ammonia and other substances are evaporated rapidly about masses of water. In making ice-cream (it makes my mouth water to write about it), we draw the heat from the cream by rapidly melting ice with salt. As

the cream freezes, we break up the crystals by stirring. The finer we break the crystals the smoother the ice-cream.

Jack Frost builds his finest, most beautiful temples under the earth, along the banks of our roadsides, and on plowed grounds. Take a walk on a cold morning, before the sun thaws Jack Frost's work. Carefully look at these temples with their crystal columns. It will pay you. You will see, too, one of Jack Frost's ways of pulverizing the surface of the ground for the use of the plants.

Usually the soil of the earth contains water. When a spadeful of earth is turned up it is damp; so is that turned up by a plow. If heat leaves the earth (radiates) until there are but thirty-two degrees or less of it showing on the thermometer, the water in the earth freezes—forms into crystals. In doing this, the water rushes through the ground to the nearest place where a crystal center has been started. These crystals frequently take the form of columns half an inch through, and as much as two inches

high. They stand close together, and are very beautiful. You can often see them along road-banks or in plowed ground. Often, when you step on an earth or gravel walk, your feet will sink and you will hear cracking. You are breaking down the ice columns beneath your feet. The water near the top of the ground freezes first. That is after the frost forms on the grass. In freezing it expands. The crystals need room. To get room they raise the earth that is on top of them. If there is a long cold spell, the freezing goes on, lower and lower, until a depth of several feet is reached. The frozen ground is lifted higher and higher. The particles of soil are crushed finer and finer by the great pressure. They are turned up and about, squeezed, mixed, ground, aired. This is Jack Frost's greatest work. He makes soil and prepares it for the plants and trees to feed upon.

When the crystals in the ground begin to melt, we call it thawing. We say, "The frost is coming out of the ground." When this happens, our wagon wheels cut through the weak-

ened crust which has been lifted by the crystals, and go down with a bump until they strike ground which has not been frozen. This is the principal reason that country roads are "bad" in the early spring. Again, the melting of the crystals sets free a large quantity of water which has to be soaked up by the earth or evaporated by the sun. If the earth and sun do not work as fast as the ice melts, we have mud. Upon every foot of our earth where the thermometer marks thirty-two or lower, Jack Frost is at work. In the neighborhood of Philadelphia he is hard at work, day and night, for nearly four months of the year. In many colder regions his work never ceases. He tears down mountainsides, splits huge rocks, lifts the pavements, throws grain and grass roots from the soil, forces huge trees apart, rips off their bark.

Jack Frost is a good, hard-working friend; he is also a powerful hurter and destroyer. He does not care a snap for anybody. He has his work to do in Nature's plan, and he does it.

IN THE DARK

IN THE DARK

If you will go into a room in the daytime, close the shutters, pull the curtains down, stuff something in any crack there may be, the room will be dark. You will notice that you have not shut the dark in, but that you have shut the light out. You will notice, too, that you do not feel one bit afraid. Maybe if you had to go into that same room in the night-time you would be a little bit scared, especially if you had to go upstairs to get into it, the wind slammed the door shut, and you were left alone in the dark.

Did you ever sit down in the daytime, and calmly think why? It is a good plan.

Perhaps I can tell you. If I can, I am sure you will feel much more comfortable about going into the dark for the rest of your lives.

As you shut the light out of the room when you made it dark, and did not shut dark in, it is

as plain as the noses on your faces, that darkness is the absence of light, and that there is no such real thing as darkness. There is such a thing as light. We see it come from the sun, the fire, the lamps. No one ever saw darkness come from anything. If you will look through a hole into a dark room you will see that it is dark. Not a bit of the darkness will come out of the hole when you take your eye away. If you will then darken the room in which you are standing, and have some one put a lamp in the dark room into which you have been looking, the light will come out of the room through the hole and make a spot of light on the wall somewhere about you. By these two trials you learn that dark does not travel and that light does.

You will very naturally ask: How does light travel? How does the light from a lamp or a window many miles away travel to our eyes on the darkest night? How does the light of a flash of lightning or the fire from a gun get to our eyes long before the sound of either the thunder or the crack of the shot?

Here is the explanation: If you throw a pebble into a still pond of water, little waves start from where the pebble strikes, and in a ring move in all directions. The force of the pebble striking the water makes the waves. Place a basin of water before you, drop something upon the center of it. The waves thus made will reach all sides of the basin. The waves coming toward where you are sitting come in a straight line. If you strike a match, or light a lamp, or set fire to the gas, the force of the burning starts waves of light which, like those in water, move in all directions until they strike against something. When these waves strike your eyes they make you see what is called light, no matter whether the waves come from a candle or come from the sun. Waves of light travel at the rate of one hundred and eighty-six thousand miles in a second. If an express train going at sixty miles an hour started to race around the world with a wave of light, the wave would go around the world over one million and a half times while the train was going once. Sound is made by

stirring the air or the particles of some body violently. If air is stirred by the force of an explosion from a gun, or by a streak of hot lightning passing through it, we hear the crack of the gun or the crash of thunder. Sound, like light, travels in waves. It travels about one thousand feet in a second. As light travels nearly ten million times faster than sound, it is easy to understand why we see the flash of a gun or a flash of lightning before we hear the gun go off or the noise the lightning makes, which is thunder. Thunder never hurt anybody. If we see the flash of lightning, the danger is over from that flash.

Take a ball of any kind out into the sunlight. You will see that the side of the ball next to the sun is bright, while the side away from the sun is much darker. Turn the ball around as often as you please, the side toward the sun will always be lightest. Hold a sheet of white paper so that the ball is between the paper and the sun, and you will see the shadow of the ball on the paper. The reason is that the rays or waves

of light from the sun cannot get through the ball—are stopped by it. Stopping the light makes a shadow. The same thing happens if you hold the ball near a lighted lamp. The reason the ball is not entirely black on the side from the sun or lamp is because the waves of light that pass the ball strike against something else and are reflected or bounced back, and in this way get behind the ball.

You all know that the earth is a very big ball—eight thousand miles through. It turns around once in twenty-four hours. Just like the ball you have held to the sun or to a lamp, the side of the earth which is turned toward the sun is always in the sunlight. The earth is so big and thick that the waves of light from the sun cannot get through it, and there is very little about the earth to bounce back the waves of light which do not strike it. Therefore, the side away from the sunlight is in the shadow the earth itself makes, and this shadow is very dark. We call it night.

If you stick a pin in your ball, and imagine

that you are that pin (a sharp, bright pin, of course), and turn the ball around away from the light, you will notice that you (the pin) are in the shadow of the ball.

Each of you is stuck on the earth somewhere. As the sun turns around he or she turns with it, like the pin in the ball. The earth turns from west to east. When it turns us to where the waves of light from the sun begin to be stopped by the earth, we begin to get into the earth's shadow. This we call evening—the evening of light, twilight or half light, or the more beautiful word, gloaming, which means glooming. As we are turned farther into the shadow, the shadow becomes darker. This darker shadow is all that dark is. What is there in it to be afraid of? Why be afraid of it more than any other shadow—even the shadow of a tree or a house, or the one we ourselves make?

If one of our feet or arms is caught in something and held fast, we feel helpless, we get scared and "holler" for help. In the dark our eyesight is held fast; we cannot use it to see

about us; we have a helpless feeling. We, perhaps, feel scared. There are no such things as ghosts, spooks, goblins, bogies. The stories told you of them are made up. You are as safe in the dark or shadow as you are in the light. I love to walk in the woods in the night-time and to listen to the night birds, the calls of insects, the rustle of night rambling animals, the distant barking of dogs, the low of cattle,—these are the voices of the night.

Two old ladies bought a folding bedstead. Every night they opened it, let it down, made up the bed carefully, and then looked under it to see whether or not there was a man there. There is a good deal in habit. Feeling afraid of the dark is a bad habit. Think about it, and break up the habit, if you have it.

OUR UNDERGROUND NEIGHBORS

OUR UNDERGROUND NEIGHBORS

One would think, if one did not think much, that there is plenty upon and over the ground to supply everything with a living, if it hunts for it. Yet there are many insects and worms, besides the ground-mole, which spend their entire lives under the ground and manage to pick up a very good living there, a living entirely to their liking.

Underground is a pretty big place. The ground-mole is seldom seen unless patiently watched for or killed by a trap; not, however, because it is a scarce animal, but because, wherever it goes, it tunnels its way and is careful to keep a covering of earth over itself. A walk almost anywhere in lawn, garden, or field, will show the raised earth over its zigzag runways.

The object of the ground-mole in making a tunnel is not that it may travel for pleasure from one place to another, but that it may find some-

thing to eat. As the mole lives entirely upon insects, grubs, earthworms, it knows that the best place to find them is where these find tender titbits in sprouting seeds and new roots. These are plentiful under grass and near the surface of the ground. Many insects, worms, grubs, do great injury to the crops of the farmer and gardener, probably without knowing it, or caring anything if they do. The ground-mole is a busy help in destroying things which are very hard for the farmer and gardener to get at. It should not be killed. It does a great deal more good than harm. We must remember that the mole is made to do things in its own particular way, and for its own use. If in making up its tunnel it bulges up our walks, uplifts the trimmed sod of our lawns, tosses out a few of our pet plants, or by boring too near their roots lets the air get at them to wilt them, kill them, it certainly displeases us. If we saw the insects or worms or grubs the mole was after, things that would eat the roots or nibble the tender bark and ends by which the roots get a living for the

plants, we would thank the mole for preserving the health and lives of the plants we are fond of.

It is a common belief that ground-moles eat newly sprouted corn, peas, and the roots of other plants. They do not. They eat animal matter only. Ground-mice frequently make use of the tunnel the mole has made, to easily find meals for themselves in seeds and tender rootlets. The mole gets the blame.

The common ground-mole, when fully grown, is seldom over six inches long from the tip of its very short, almost bare, tail to the tip of its bare, sharp, limber nose. Its body is round, soft, without any waist worth mentioning. Its fur is lead-color and has a beautiful luster, rub it whatever way you may. It is short, velvety, and, like the nap of velvet, stands on end. Whether the mole backs or goes ahead, its fur keeps the earth from getting to its skin.

The eyes of a mole are so small and hidden by fur that the only way to find them is to blow about where they are thought to be, thus parting the fur until they are found. As the mole

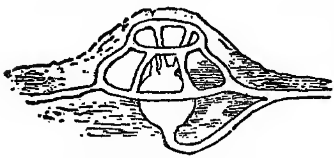
lives under ground, it has not much use for eyes. They would be a bother if they were large; the dirt would get in them. It is stated that a mole can run its eyes out beyond the fur about them when it wishes to look around. I have not seen it done,—maybe because the mole did not care to see me.

Though a mole seldom needs eyes, it has plenty of use for its nose. This tells it when a worm is near, even which way to find the easiest digging. Its ears are very small, but they are very good. They help the mole's nose in finding food. They tell the mole of danger. It is hard to travel quietly enough to catch a mole at work.

The fore-paws and shoulders of the mole are wonderfully strong. They are made for digging. Every one who has tried to dig out a ground-mole with a spade, knows how fast it can dig away from danger. The only way to get one alive is to quietly, spade in hand, watch until the mole begins to raise the earth in lengthening its tunnel, then dart the spade under it and quickly

throw the mole out. It cannot run very fast, but it must be quickly caught by the tail or it will dive into the ground and leave one looking at nothing but a hole.

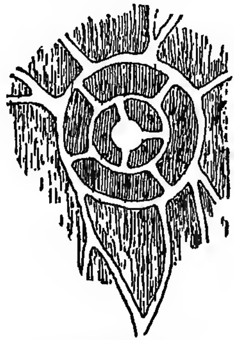
In making its tunnel the mole does not throw the earth behind it. With its great flat paws, armed with thick, sharp claws, it tears apart the earth in front of it, forces its body forward, lifts the earth above it with its strong shoulders, smooths the sides as its furred body passes along, and leaves behind it an open tunnel which it can use as it pleases. The tunnels run out (radiate) from the mole's nest, like the spokes of a wheel from its hub.



Nest of the ground-mole.

The home or nest of a mole looks, in a picture of one, like a basket made of galleries, turned upside down. Though not far under ground, it is so made that rain water drains away from it. In its bed of soft dead grass, roofed with earth, the mole can laugh at storms.

It does not sleep (hibernate) during the winter, as many animals do. When the ground is frozen hard and deep it sometimes comes out of its hole,—perhaps to get water; for moles are great drinkers. When, as a boy, I used to trudge across fields and along roads, two miles and a half, over the Springton Hills to a country school, deep snow, packed and sleeted



How the mole leaves its home.

hard, filled the way in some places. Where the snow was blown into drifts the road was left bare in places. I caught moles on the snow. They came from the ground in the bare places, lost their way on the ice-covered snow, and could not dig through it to get back to earth again. The skins made handsome purses. The height of my wishes was to get enough skins to make my father a mole-skin vest, very fashionable at one time, but I grew to be a man before I had half enough. And I am glad of it. I did not know

then what a friend to the farmer the ground-mole is.

Cats and dogs catch the ground-moles but they do not eat them. They have a strong, musk-like smell, which is not pleasing to such, sometimes, particular creatures.

Mrs. Mole has from four to seven children at a time, once a year. I once accidentally dug up a nest of five. They were three or four times as ugly as young mice. Yet I do not believe their mother thought so.